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to the Royal Observatory. The conversion of the co-ordinates into Right Ascension and Declination for such of these stars as have been previously observed and catalogued is proceeding. The fourth volume of the Oxford University Observatory Zone has been also published, containing 65,808 stars, which completes the publication of the measures of the stars from Dec. 32° N. to 27° N., and leaves two similar volumes to finish this section. A second volume, numbered Tome iii., containing all the stars between R.A. 6^h and 9^h in the zone Dec. 39° to 47° N., has been issued from the Helsingfors Observatory, which gives equatorial co-ordinates in the complete way explained when the first volume was published in 1904. From comparison of dates, an estimation may be made of the time required to complete the eight volumes, which will contain the catalogue of this zone. Neither Potsdam nor the French Observatories have published any instalments during the year, owing possibly to changes in the Directorships. The reports from the Cape and Melbourne show that the measuring of the stars in the South Pole region 41° to the South Pole is proceeding, and the formation of the catalogue for the remaining parts of the sky 47° to 64° N. Declination, and 3° to 41° S., is proceeding, it is believed, with more or less rapidity, but exact reports of the state of the work will no doubt be presented at the meeting of the Permanent Committee, which is to be held at Paris in April of this year.

The number of enlargements of chart plates distributed up to the end of December last is

Paris	331	San Fernando	165
Algiers	309	Tacubaya	61
Toulouse	158	Greenwich	934
Bordeaux	70		

H. P. H.

Stellar Spectroscopy in 1908.

Nebula.—The nebula HV 15 Cygni lies in the Milky Way, and is remarkable for its considerable wispy extent. It appears to form a boundary, extending over about 2°, between two regions differing much in richness of stars. The work of Max Wolf (*Ast. Nach.*, **178**, p. 379) shows that its spectrum proclaims it to be a gaseous nebula.

Sixth Type of Stellar Spectra.—Professor E. C. Pickering proposes to include stars with peculiar spectra, which cannot be assigned to already recognised classes, in a special class R. He gives a list of 51 stars which are gathered together under one type, which he suggests should be regarded as a sixth type of stellar spectra (*H.C.O. Circular*, No. 145, and *Ast. Nach.*, **179**, 373), and gives in his circular No. 145 a photographic reproduction of spectra of 5 stars. The photograph is not given in *Ast. Nach.*

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Classification of Stellar Spectra.—Several papers of interest in this connection have been published in the course of the year. Amongst them we may refer to the following:—

Gibson and Pearson (*M.N.*, lxviii. 415). On correlation of stellar characters.

Franks (*M.N.*, lxviii. 672). The relation between star-colours and spectra.

Franks (*M.N.*, lxix. 106). Analysis of the colours and magnitudes of 3630 stars.

Bell (*M.N.*, lxix. 108). Note on spectral class and stellar colours.

Parkhurst and Jordan (*Astroph. Jour.*, xxvii. 169). The photographic determination of star-colours and their relation to spectral type.

Herr Hertzsprung discusses the stars in the subdivisions *c* and *ac* in Miss Maury's classification of stellar spectra (*Ast. Nach.*, **179**, 373).

Sir Norman Lockyer discusses the general spectra of certain typical stars (β Persei, α Pegasi, ι Orionis, α Canis Minoris) and the spectra (in the green region) of α Cygni, Sirius, Rigel, Capella, and Arcturus (London, Wyman & Sons, 1908).

Studies of Special Stars.—ζ *Ursæ Majoris.*—The brighter component of Mizar was shown by the Harvard College observers in 1890 to be a spectroscopic binary. Herr Ludendorff (*Ast. Nach.*, **177**, 7) has studied the spectrum of the fainter component, and finds it belongs to Vogel's class I *a* 2. The velocity in the line of sight is − 12·5 km./sec., which is the mean of 14 observations in 1905–07, ranging from − 7·9 to − 17·7. It would thus seem to move similarly to Mizar, Vogel's value for that star being − 14·2 km./sec.

Whilst Herr Ludendorff hesitates to ascribe the large range in his values of the radial velocity to real changes in the star, Professor Frost (*Ast. Nach.*, **177**, 171) regards the changes as real, and records that the Yerkes observers find values between − 17 and + 10 km./sec. This star is accordingly entered in the following section.

ε *Ursæ Majoris.*—This star was observed by Vogel in 1889, and its velocity was found to be − 30 km./sec. Adams, again, observed it in 1902, and found the velocity to be − 9 km./sec., a value which was confirmed by observations at Potsdam in 1903. Mr. Baker, observing at Allegheny in 1907, finds the velocity to be − 7 km./sec. (*Allegheny Publications*, vol. i. 23).

α *Orionis.*—Mr. H. C. Plummer has studied the evidence of variability of radial velocity of this star, and concludes that it points to a minimum of about + 18 km./sec. in 1898, and a maximum of about + 26 in 1905 or 1906 (*Ast. Soc. Pac.*, xx. 227).

α Persei.—Herr Goos has studied the velocity of this star at the Bonn Observatory (*Ast. Nach.* **180**, 49).

A list of stars having peculiar spectra is issued by Professor Pickering (*H.C.O. Circ.* 143, and *Ast. Nach.*, **179**, 191). It deals with 28 new variables and 6 other stars.

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Variable Radial Velocity.—Notes on variability of velocity are given for the following stars :—

ζ Canis Majoris	Lick Observatory	*L.O.B.*	No. 146.
τ Puppis	,,	,,	,,
o Velorum	,,	,,	,,
d Carinæ	,,	,,	,,
q Velorum	,,	,,	,,
ν Puppis	,,	,,	,,
ν Octantis	,,	,,	,,
γ Persei	,,	,,	,,
ξ Tauri	,,	,,	,,
θ^2 Tauri	,,	,,	,,
l (53) Eridani	,,	,,	,,
ζ Aurigæ	,,	,,	,,
ρ Orionis	,,	,,	,,
β Canis Majoris	,,	,,	,,
ν_2 Draconis	,,	,,	,,
70 Ophiuchi	,,	,,	,,
111 Herculis	,,	,,	,,
φ Cygni	,,	,,	,,
δ Aquilæ	Potsdam (Ludendorff)	*Ast. Nach.*,	**178**, 53.
o Andromedæ	,,	,,	,,
9 Camelopardalis	,,	,,	,,
τ Cygni	,,	,,	,,
β Scorpii	,,	,,	,,
ζ Ursæ Majoris (faint *)	Frost	*Ast. Nach.*,	**177**, 171.

It is interesting to note that there is only one case in these 23 systems where the spectra of both components are visible, viz. φ Cygni.

Orbits of Spectroscopic Binaries.—Orbits have been calculated for the following spectroscopic binaries :—

o Leonis	H. C. Plummer	*L.O.B.*, No. 133
β Herculis	,,	,, ,,
ω Draconis	A. B. Turner	,, ,,
α Andromedæ	H. Ludendorff R. H. Baker	*Ast. Nach.*, **178**, 23 *Allegheny Publns.*, i. 17
θ Aquilæ	R. H. Baker	,, ,, i. 45
η Virginis	W. E. Harper	*Astroph. Jour.*, xxvii. 160
ι Orionis	Plaskett and Harper	,, ,, 272
13 Ceti	P. Fox	,, ,, 372
ψ Orionis	Plaskett	,, xxviii. 266
ι Orionis	,,	,, ,, 274
ι Pegasi	Zurhellen	*Ast. Nach.*, **177**, 334
β Persei (Algol)	Schlesinger and Curtiss R. H. Curtiss Belopolsky	*Allegheny Publns.*, i. 25 *Astroph. Jour.*, xxviii. 150 *Mitth. Pulkova*, ii., No. 22
α Aurigæ	F. Goos	*Inaug. Diss. Bonn*, 1908, *from* 35 *observations at Bonn.*

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Herr Belopolsky has studied Algol specially with a view to detecting evidence of dispersion in space.

Professor Frost publishes information relating to spectroscopic binaries under observation at different observatories (*Astroph. Jour.*, xxvii. 161).

Mr. Schlesinger contributes a paper on "The determination of the orbit of a spectroscopic binary by the method of least squares" (*Allegheny Publications*, vol. i. 33).

Mr. W. F. King describes a graphical method of dealing with the same problem (*Astroph. Jour.*, xxvii. 126).

Mr. H. C. Plummer gives a brief summary of various methods used in determining orbits (*Astroph. Jour.*, xxviii. 212).

Mr. Heber D. Curtis gives a similar summary (*Astr. Soc. Pac.*, vol. xx. p. 133).

Herr W. Zurhellen contributes further remarks on the determination of orbits (*Ast. Nach.*, 177, 321), and also criticises the work of King and K. Laves (*loc. cit.*, 335).

Spectra of the Major Planets.—Striking photographs of the spectra of the planets Jupiter, Saturn, Uranus, and Neptune, compared with the spectrum of the Moon, have been obtained by Mr. Slipher at the Lowell Observatory (*Ast. Nach.*, 179, 241).

Mr. Slipher also communicates an interesting note concerning the spectrum of Mars (*Astroph. Jour.*, xxviii. 397).

New Spectrographic Installations.—Mr. Plaskett has continued his careful work of studying conditions of star-images in spectrographic work (*Astroph. Jour.*, xxvii. 139).

His experiments confirm the views of Mr. Newall with respect to the size of effective tremor discs and cores. He has further studied the effect of increasing the slit width upon the accuracy of radial velocity determinations (*Astroph. Jour.*, xxviii. 259).

The Publications of the Potsdam Observatory contain two valuable memoirs of recent date. The one by Dr. Eberhard deals with the spectrograph No. IV. (*Publ. Potsd. Obs.*, vol. xviii.); the other, by Dr. Hartmann, shows how much trouble has been experienced in the perfecting of the 80-cm. objective of that observatory, and with what care the testing has been carried out (*ibid.*, vol. xv. ii.).

Standards of Wave-length.—Messrs. Fabry and Buisson contribute a paper summarising their determinations of wave-lengths of iron lines between λ 2373 and λ 6495 (*Astroph. Jour.*, xxviii. 169).

Mr. Pfund describes interesting and important experiments throwing light on the accuracy of results obtained by interferometer methods (*Astroph. Jour.*, xxviii. 197).

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